National Aeronautics and Space Administration

ARSET

Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery

Instructors: Cindy Schmidt and Amber McCullum

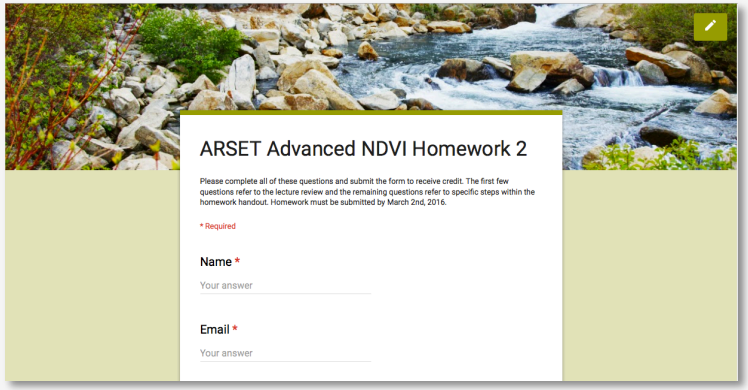
Week 2

Course Structure

- One lecture per week – every Wednesday from February 10 to March 2 at 12:00-1:00pm EST (-05:00 UTC)
  - Lectures
  - In-class exercise
  - Q&A
  - Homework exercises
- Webinar recordings, PowerPoint presentations, in-class exercises, and homework assignments can be found after each session at:
  - http://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index
- Q&A: Following each lecture and/or by email (cynthia.l.schmidt@nasa.gov) or (amberjean.mccullum@nasa.gov)

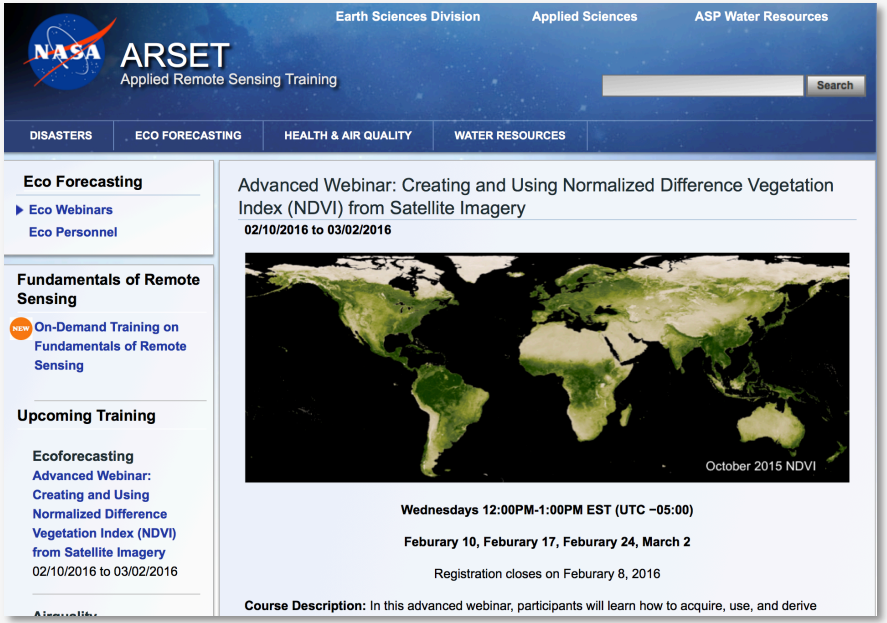
Homework and Certificates

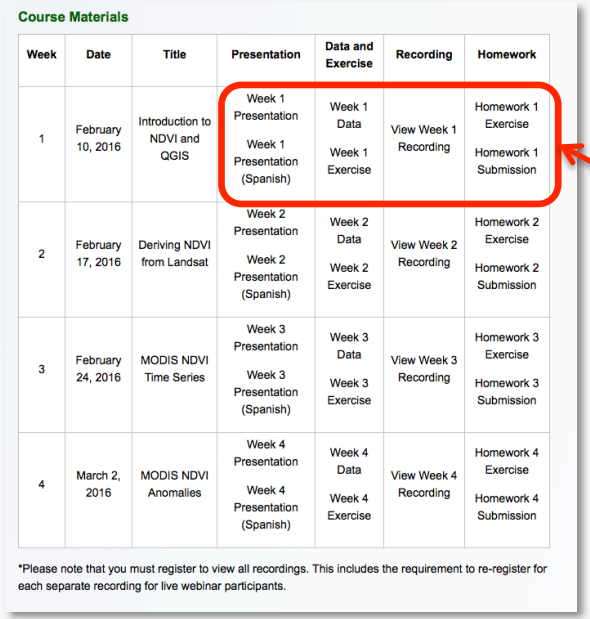
- Homework
  - Hands-on exercise each week
  - Answers must be submitted via Google Form
- Certificate of Completion:
  - Attend all 4 webinars
  - Complete all 4 homework assignments by the deadline (access from ARSET website)
    - Week 2 Deadline: Wednesday March 2nd
  - You will receive certificates approximately 2 months after the completion of the course from: marines.martins@ssaihq.com



Accessing Course Materials

- http://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index





Course Materials

Week	Date	Title	Presentation	Data and Exercise	Recording	Homework
1	February 10, 2016	Introduction to NDVI and QGIS	Week 1 Presentation Week 1 Presentation (Spanish)	Week 1 Data Week 1 Exercise	View Week 1 Recording	Homework 1 Exercise Homework 1 Submission
2	February 17, 2016	Deriving NDVI from Landsat	Week 2 Presentation Week 2 Presentation (Spanish)	Week 2 Data Week 2 Exercise	View Week 2 Recording	Homework 2 Exercise Homework 2 Submission
3	February 24, 2016	MODIS NDVI Time Series	Week 3 Presentation Week 3 Presentation (Spanish)	Week 3 Data Week 3 Exercise	View Week 3 Recording	Homework 3 Exercise Homework 3 Submission
4	March 2, 2016	MODIS NDVI Anomalies	Week 4 Presentation Week 4 Presentation (Spanish)	Week 4 Data Week 4 Exercise	View Week 4 Recording	Homework 4 Exercise Homework 4 Submission

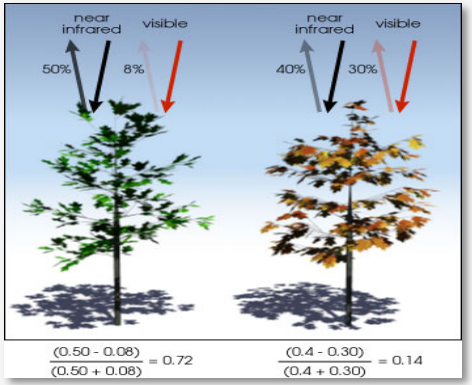
*Please note that you must register to view all recordings. This includes the requirement to re-register for each separate recording for live webinar participants.

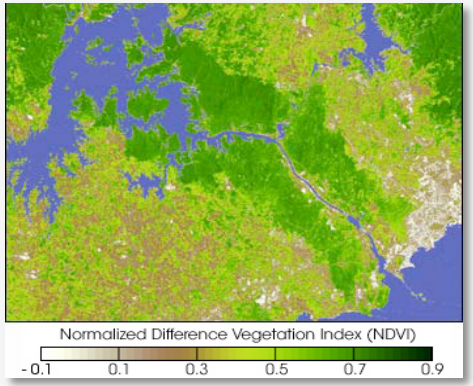
Course materials are provided here using each specified link and will be active after each week

Course Outline

Week 1

Overview of NDVI and QGIS



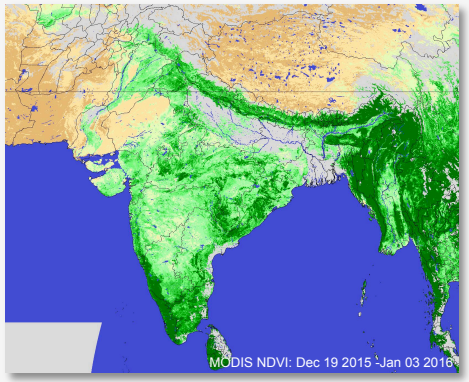


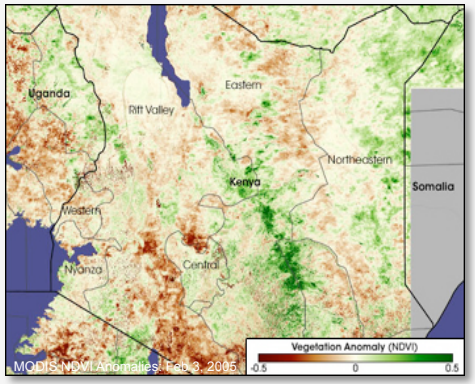
Week 2

NDVI with Landsat

Week 3

MODIS NDVI Time Series



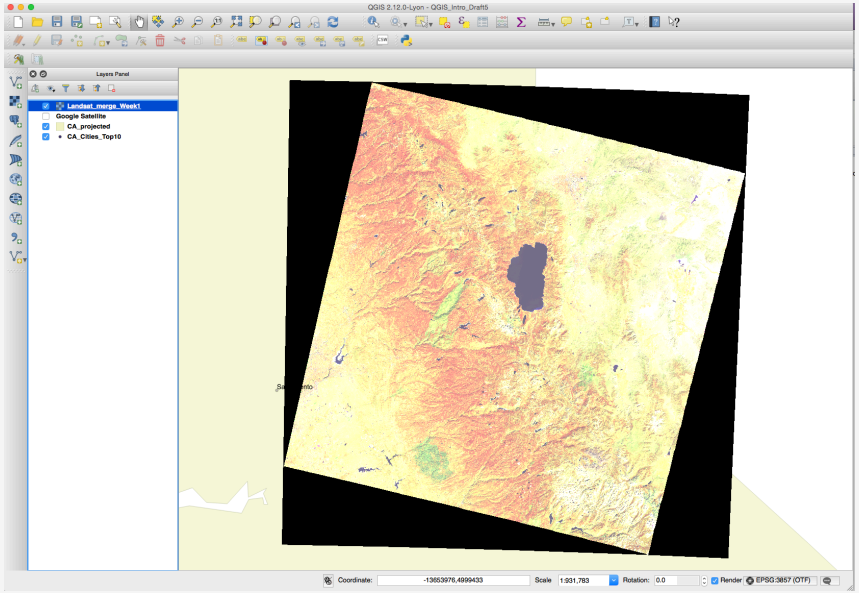


Week 4

MODIS NDVI Anomaly Mapping

Week 2 Agenda

- Review of Landsat Bands
- Acquiring Landsat Images
- In-class exercise: Deriving NDVI from Landsat using QGIS
- Q&A



Week 1 Review

- What is NDVI
- NDVI Applications and Examples
- NDVI Anomalies
- QGIS Introduction

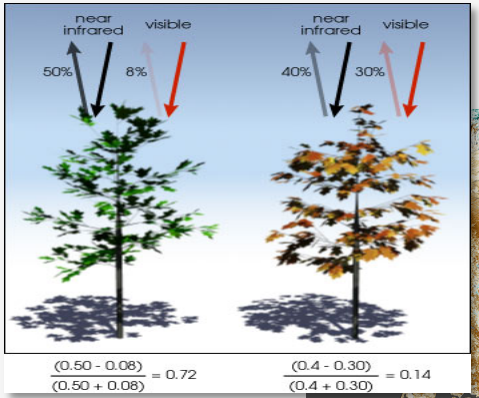


Image Credit: Robert Simmon

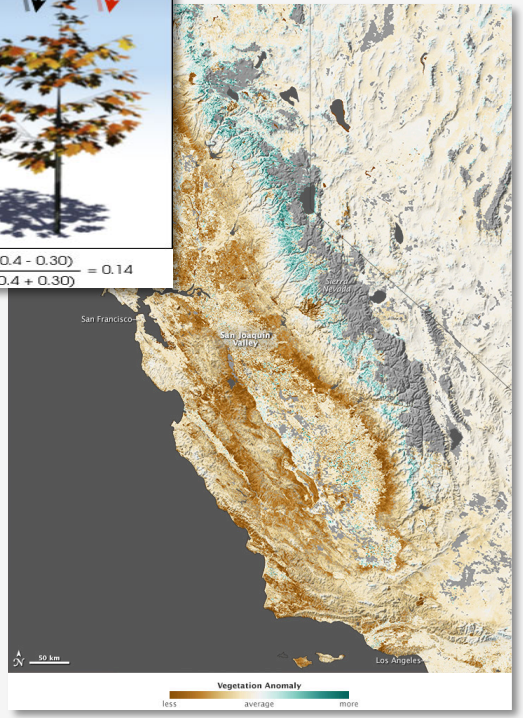
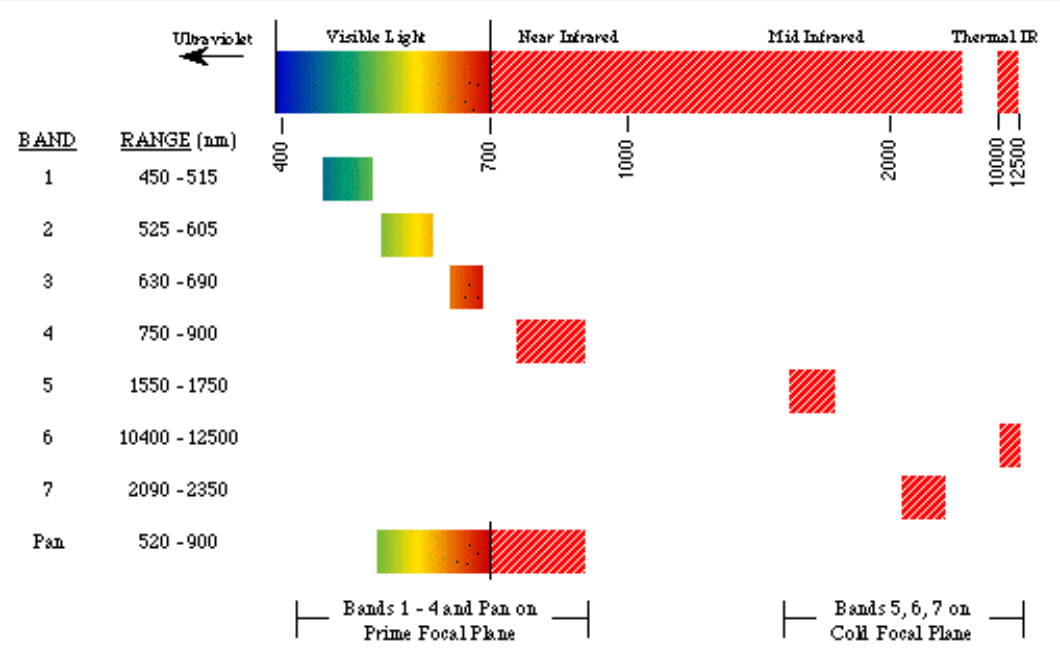


Image Credit: NASA Earth Observatory

Landsat Review

Spectral Characteristics of Landsat

- Landsat instruments measure primarily light that is reflected from Earth's surface (with one exception)
- Landsat instruments are designed to detect visible and infrared (near and mid) wavelengths.



Landsat bands of ETM+ (Landsat 7)

Characteristics of Landsat 4, 5, and 7

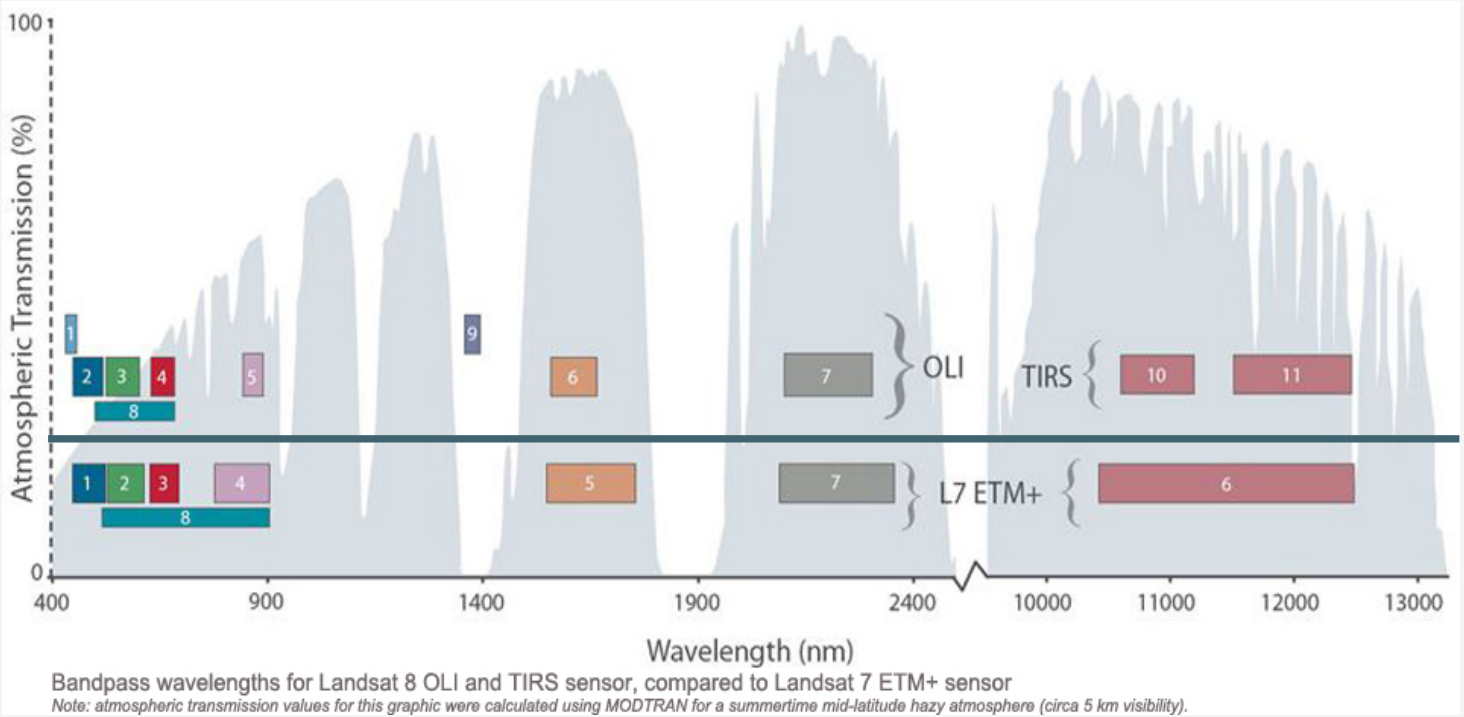
Bands	Wavelength (micrometers)	Resolution (m) Landsat 4-5 (TM)	Resolution (m) Landsat 7 (ETM+)
Band 1-Blue	0.45-0.52	30	30
Band 2 Green	0.52-0.60	30	30
Band 3- Red	0.63-0.69	30	30
Band 4-Near Infrared	0.76-0.90	30	30
Band 5- Shortwave Infrared 1	1.55-1.75	30	30
Band 6- Thermal Infrared	10.40-12.50	120	60
Band 7- Shortwave Infrared 2	2.08-2.35	30	30
Band 8-Pan	0.52-0.90	--	15

Characteristics of Landsat 8

Bands	Wavelength (micrometers)	Spatial Resolution (meters)
Band 1-Coastal aerosol	0.43-0.45	30
Band 2- Blue	0.45-0.51	30
Band 3- Green	0.53-0.59	30
Band 4- Red	0.64-0.67	30
Band 5- Near Infrared	0.85-0.88	30
Band 6- SWIR 1	1.57-1.65	30
Band 7- SWIR 2	2.11-2.29	30
Band 8-Panchromatic	0.50-0.68	15
Band 9-Cirrus	1.36-1.38	30
Band 10- Thermal Infrared 1	10.60-11.19	100*
Band 11- Thermal Infrared 2	11.50-12.51	100*

* Resampled to 30 meters

Landsat 7 vs. Landsat 8



Bandpass wavelengths for Landsat 8 OLI and TIRS sensor, compared to Landsat 7 ETM+ sensor

Note: atmospheric transmission values for this graphic were calculated using MODTRAN for a summertime mid-latitude hazy atmosphere (circa 5 km visibility).

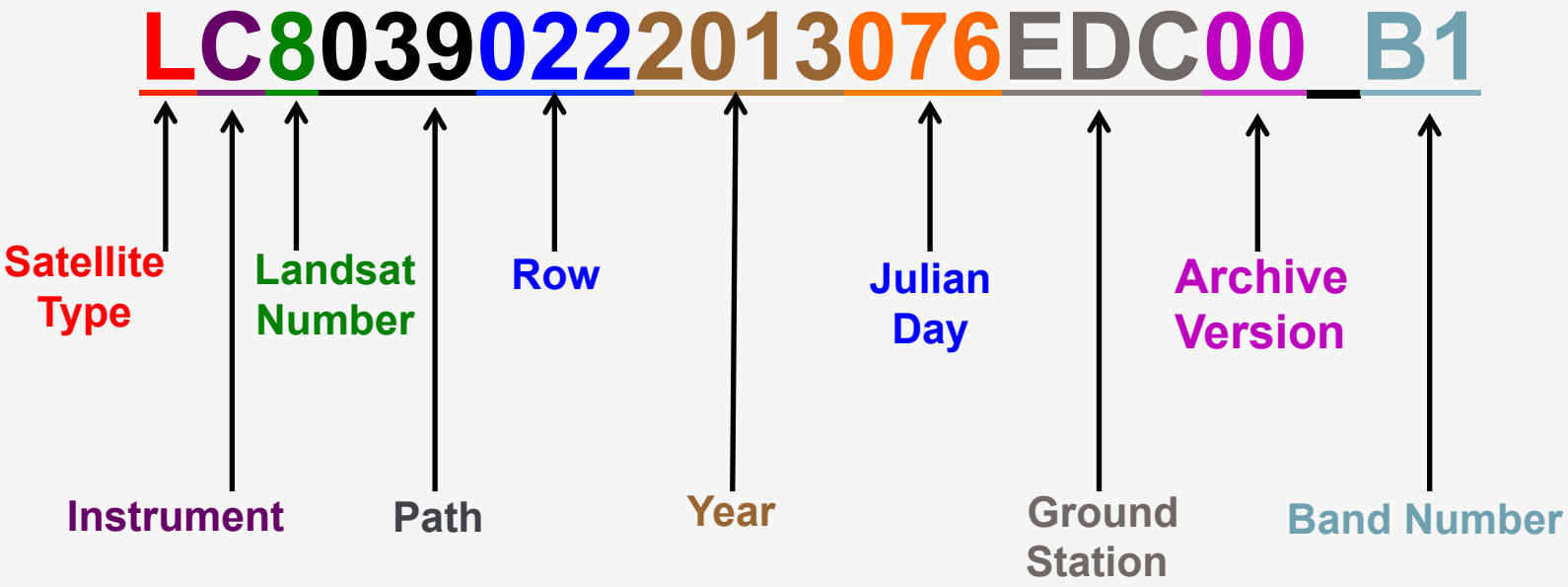
Landsat 8
Top

Landsat 7
Bottom

Landsat Bands for NDVI

Wavelengths	Landsat 8 Bands	Landsat 4,5, 7 Bands
Coastal aerosol	Band 1	
Blue	Band 2	Band 1
Green	Band 3	Band 2
Red	Band 4	Band 3
Near- Infrared	Band 5	Band 4
SWIR 1	Band 6	Band 5
SWIR 2	Band 7	Band 7
Panchromatic	Band 8	Band 8 (L7)
Cirrus	Band 9	
Thermal Infrared 1	Band 10	Band 6
Thermal Infrared 2	Band 11	

Landsat Naming Convention



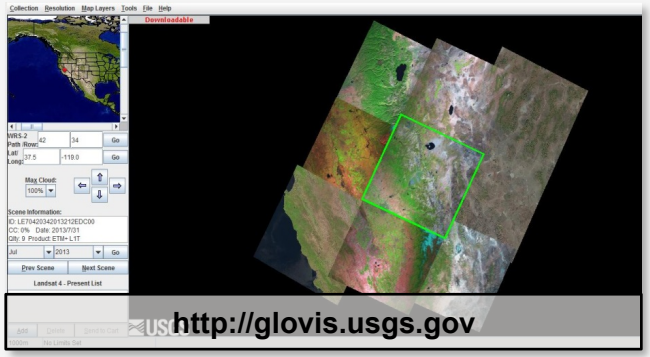
*Instrument can be C: Combined, OLI: Operational Land Imager, or TIS: Thermal Infrared System

Where to Obtain Landsat Images

The LandsatLook Viewer

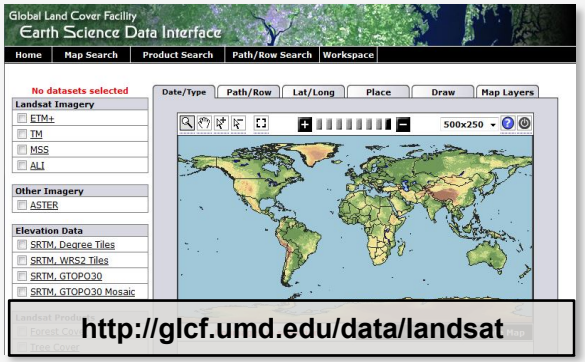
http://landsatlook.usgs.gov

GloVis



http://glovis.usgs.gov

Global Land Cover Facility



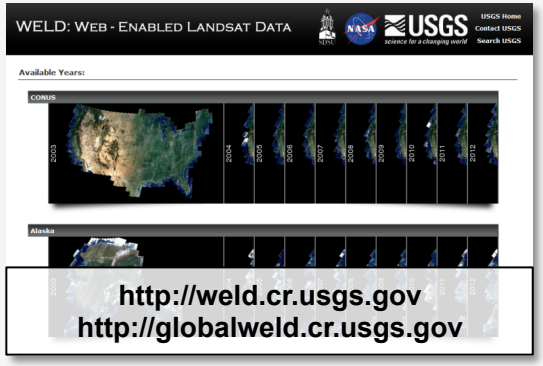
http://glcf.umd.edu/data/landsat

Earth Explorer

http://earthexplorer.usgs.gov

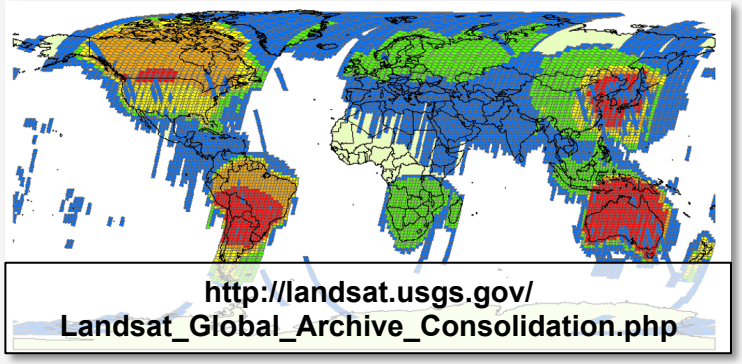
Where to Obtain Landsat Images

WELD

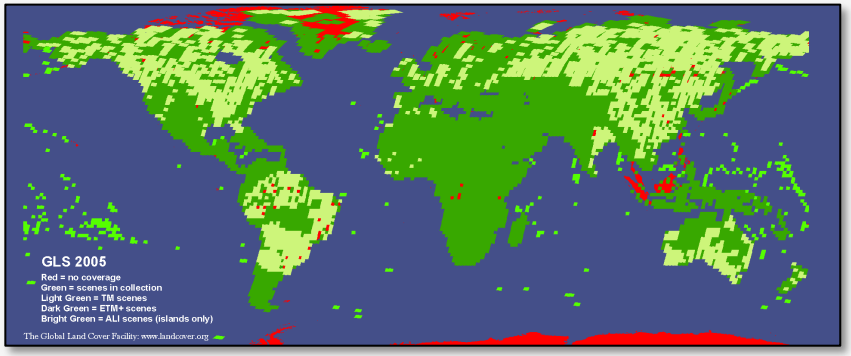


http://weld.cr.usgs.gov
http://globalweld.cr.usgs.gov

Landsat Global Archive Consolidation (USGS)



http://landsat.usgs.gov/
Landsat_Global_Archive_Consolidation.php



Global Land Survey

- Not a data portal, but a global collection of cloud free Landsat images from 1975-2008.
- Time series include (GLS 1975, GLS 1990, GLS 2000, GLS 2005, GLS 2010)
- Acquire GLS datasets through Earth Explorer, GloVis, and GLCF

Exercise: Calculating NDVI Using Landsat Imagery

Contacts

- ARSET Land Management and Wildfire Contacts
  - Cynthia Schmidt: Cynthia.L.Schmidt@nasa.gov
  - Amber McCullum: AmberJean.Mccullum@nasa.gov
- General ARSET Inquiries
  - Ana Prados: aprados@umbc.edu
- ARSET Website:
  - http://arset.gsfc.nasa.gov/

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Thank You

Next Week:

MODIS NDVI Time Series